

## **REMARKS**

Applicant respectfully requests reconsideration of this application, as amended, and consideration of the following remarks. Claims 1-15 have been amended. Claims 1-15 remain pending. Claims 1 and 8 stand rejected under 35 U.S.C. 112, first and second paragraph. Claims 1-4, 6-11 and 13-15 stand rejected as being unpatentable under 35 U.S.C. 102(b). Claims 5 and 12 stand rejected as being unpatentable under 35 U.S.C. 103(a).

### **Amendments**

#### ***Amendments to the Claims***

Applicant has amended the claims to more particularly point out what Applicant regards as the invention, i.e., a method for detecting an endpoint to a main etch process of a layer before etching an underlying layer, wherein the endpoint is determined by detecting a first intensity maximum followed by a next detectable second intensity maximum. These amendments are supported by the as filed specification and claims and therefore no new matter has been added as a result of these amendments.

### **Rejections**

#### ***Rejections under 35 U.S.C. §112 First and Second Paragraph***

Claims 1 and 8 stand rejected under 35 U.S.C. §112, first and second paragraph as the Examiner contends that the term “directly” is “not described in the specification” and is “unclear” or “indefinite”. Applicant has amended claims 1 and 8 to remove the term “directly.” Applicant therefore respectfully requests this rejection under 35 U.S.C. §112 first and second paragraphs be withdrawn.

#### ***Rejections under 35 U.S.C. §102(b)***

Claims 1-4, 6-11, and 13-15 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Litvak (US 5,499,733, hereinafter the Litvak reference). Applicant respectfully traverses the rejection as described in more detail below. Applicant contends the Litvak reference does not teach or suggest a method of detecting an

endpoint of a main etch process as claimed herein. Applicant, therefore respectfully requests this rejection under 35 U.S.C. § 102(b) be withdrawn.

***Rejections under 35 U.S.C. §103(a)***

Claims 5 and 12 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Litvak (US 5,499,733, hereinafter the Litvak reference) in view of Applicant's Admitted Prior Art. Applicant respectfully traverses the rejection as neither the Litvak reference, nor the Admitted Prior Art either alone or in combination teach or suggest a method of detecting an endpoint of a main etch process as claimed herein.

The Litvak reference teaches a method for detecting an endpoint of an etch process when the layer being etched has been removed to expose and begin etching a material that underlies the layer being etched (i.e., when breakthrough occurs). The Litvak reference further teaches that the light "is directed ***through the substrate*** of the article being processed (e.g., from the backside of a wafer being etched) reflected off the layer being processed and then directed back through the substrate before being detected. In this way, ***the beam avoids having to pass through any mist, fog or liquid layer that exists on the side of the substrate carrying the layer*** being processed." emphasis added (Col 3, Ln 46-52). See also "Indeed, in actual practice, there may be many more reflections than shown in the simplified case of FIGS. 3 and 4. This is because there may be additional layers between the substrate and the top layer being processed. ***The method being described is suitable only, of course, if these intermediate layers are sufficiently transparent to the radiation to allow a signal to be reflected from the top layer and out of the bottom of the article.***" emphasis added (Col 8 Ln 63-67). However, the Applicant concedes that Litvak also teaches (at Col. 13, Ln 5-20) that the etch endpoint ***can be*** determined by measuring multiple maximums of reflected intensity that are reflected directly from the layer being polished in a CMP operation (i.e., the "front side of the wafer"). However, additional steps are required to perform this measurement. Specifically, that such "front side ***observation is not practical unless*** the block 267 and abrasive fluid 269 are first removed from the structure being worked upon." (Emphasis added, Col 13, Ln 12-15). Litvak does not delve on any detail of the processes required to remove the block 267 and abrasive fluid 269 as these are not simple processes.

As a result, Litvak, cannot examine the front side while the front side is being polished and therefore the polishing process (i.e., CMP) must be stopped, at least temporarily, so that the “front side observation” can occur. In effect, Litvak cannot perform the observation as part of applying the CMP process but rather as an interruption of it. Further, it is well known in the art of CMP that the abrasive fluid is not easily removable typically requiring rinsing and or cleaning operations to remove the abrasive fluid. Further, it is well known in the art of CMP that the abrasive fluid is not easily replaceable so to quickly and easily resume the CMP polishing operation as the proper and effective distribution of the abrasive fluid is of paramount importance and requires precise controls of many variables to perform correctly. In short, Litvak’s front side observation is *not* a simple process involving only a slight interruption of the CMP process to perform the “front side observation” but rather a much more complex process of cleaning and rinsing the front side followed by a complex process of re-distributing and applying the abrasive fluid.

Litvak recognized this difficulty on interrupting the CMP process and therefore teaches, primarily, that light is “directed *through the substrate* of the article being processed ... In this way, *the beam avoids having to pass through any mist, fog or liquid layer that exists on the side of the substrate carrying the layer.*” (emphasis added, Col 3, Ln 46-52)

The Litvak reference does not teach or suggest “directing radiant energy at two or more wavelengths directly onto a layer to be etched while the main etch process is being applied, without requiring the main etch process be interrupted.

As discussed above, Litvak teaches that the detected light maximum changes due to actual breakthrough to the layer underlying the layer being processed and not before breakthrough. The Litvak reference does not teach or suggest that while applying a main etch process, a first intensity maximum, at a first wavelength, can be detected and is followed by a next detectable second intensity maximum, at a second wavelength. Further, that the first maximum is a last detected maximum of intensity of the first wavelength to occur prior to the estimated main etch endpoint and the

second intensity maximum being detected before all of the first layer is removed and *without etching into an underlying layer*.

The Litvak reference further does not read on Applicant's "main etch" as stated by the Examiner because, Litvak does not teach or suggest that *the sequence* of a maximum of a first reflected wavelength *followed by* a maximum of a second reflected wavelength can indicate an ever thinner layer being etched *without etching through to an underlying layer*.

Neither Litvak nor Applicant's Admitted Prior Art, whether considered individually or in combination, teach or suggest detecting the sequence of maximums can identify a main etch endpoint without etching through to an underlying layer.

The cited references illustrate that the importance of Applicant's *sequence of first and second maximums* was *neither known nor obvious* to those skilled in the art or the importance the sequence of maximums would have been specifically described. Further, as stated by the Applicant, the advantage provided by detecting *the sequence of maximums* (i.e., a more accurate main etch endpoint thereby allowing a shorter finish etch process and a faster total etch process including the main etch and the finish etch) is also not described by the cited references.

As to claims 1 and 8, neither the Litvak reference, nor the Applicant's Admitted Prior Art, either alone or in combination disclose or suggest using a precise sequence of two or more intensity maximums of two or more different wavelengths that are reflected from the layer actually being etched, without interrupting the main etch process, can accurately detect a main etch process endpoint without breakthrough to the underlying layer. Accordingly, Applicant respectfully submits that Applicant's invention as claimed in claims 1 and 8 is not rendered obvious by either of the Litvak reference, or the Applicant's Admitted Prior Art reference, alone or in combination, and respectfully request the withdrawal of the rejection under 35 U.S.C. § 103(a). Claims 1 and 12 depend from claims 1 and 8 respectively and are patentably distinct for at least the reasons set forth above with regard to claims 1 and 8. Therefore, Applicant respectfully contends that claims 1 and 12 are allowable over the

cited references and respectfully request the withdrawal of the rejection under 35 U.S.C. § 103(a).

### **SUMMARY**

In view of the foregoing amendments and remarks, Applicant respectfully submits that the pending claims are in condition for allowance. Applicant respectfully requests reconsideration of the application and allowance of the pending claims.


If the Examiner determines the prompt allowance of these claims could be facilitated by a telephone conference, the Examiner is invited to contact George B. Leavell at (408) 749-6900, ext 6923.

### **Deposit Account Authorization**

Authorization is hereby given to charge our Deposit Account No. 50-0805 (Order No. LAM2P282) for any charges that may be due or credit our account for any overpayment. Furthermore, if an extension is required, then Applicant hereby requests such extension.

Respectfully submitted,

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